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PACIFIC GAS AND ELECTRIC COMPANY

SYSTEM RESOURCE PLAN

**ORDER INSTITUTING RULEMAKING TO INTEGRATE AND REFINE
PROCUREMENT POLICIES AND CONSIDER LONG-TERM
PROCUREMENT PLANS**

UTILITY SPECIFIC SUPPORTING TESTIMONY



PACIFIC GAS AND ELECTRIC COMPANY
SYSTEM RESOURCE PLAN
UTILITY SPECIFIC SUPPORTING TESTIMONY

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**PACIFIC GAS AND ELECTRIC COMPANY
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A. Introduction and Summary of Recommendations

Track I of the 2010 Long Term Procurement Plan (“LTPP”) proceeding (Rulemaking 10-05-006) is focused on identifying “CPUC-jurisdictional needs for new resources to meet system or local resource adequacy over the 2011-2020 planning horizon, including issues related to long-term renewables planning and need for replacement generation infrastructure to eliminate reliance on power plants using once-through-cooling (OTC).”^[1] Pacific Gas and Electric Company (“PG&E”), Southern California Edison Company and San Diego Gas & Electric Company (jointly the “Investor-Owned Utilities” or “IOUs”) are submitting Joint IOU Testimony that addresses the IOU Common Scenarios, results and metrics performed by the IOUs, and the metrics for the California Public Utilities Commission (“CPUC” or “Commission”)-Required Scenarios.^[2] This separate testimony is intended to present and support PG&E’s specific Track I recommendations and PG&E’s local capacity requirements. In sum, PG&E recommends the following:

- The Commission should not render a decision regarding integration need, as the analysis and results are premature and inconclusive; and
- The Commission does not need to authorize procurement authority relating to local capacity requirements for PG&E’s service area at this time.

The remaining sections of this testimony are organized as follows:

- Section B – Background
- Section C – Operating Needs to Integrate Renewable and Non-Dispatchable Resources
- Section D – Once-Through Cooling Issues and Local Capacity Requirements

[1] *Assigned Commission and Administrative Law Judge’s Joint Scoping Memo and Ruling* (“Scoping Memo”), issued December 3, 2010, at p. 4.

[2] The metrics (Step 3) for the CPUC-Required Scenarios is part of the Joint IOU Testimony as Appendix A, and is sponsored by Energy and Environmental Economics, Inc.

- Section E – Conclusion

B. Background

To perform the Track I system need determination, the IOUs were required by the Commission to “study four different Renewables Portfolio Standard (“RPS”) scenarios that achieve a 33% RPS by 2020”^[3] using an analytic framework that has been developed by the California Independent System Operator (“CAISO”). These required scenarios are: (1) Trajectory; (2) Time-Constrained; (3) Cost-Constrained; and (4) Environmentally-Constrained (collectively the “CPUC-Required Scenarios”). In addition, the IOUs have worked together to prepare a “Joint Analysis” which supplements the record by providing analysis of additional plausible scenarios (“IOU Common Scenarios”) over the planning period to 2020. The IOU Common Scenarios were developed using the same input assumptions that were used for the four CPUC-Required Scenarios, but were modified to reflect alternative assumptions. One of the alternative assumptions relates to RPS resources. The Joint Analysis retains the assumption that the 33% RPS requirement is met by 2020, but uses a different mix of renewable resources that is consistent with the IOUs’ current portfolio of contracts. The CPUC-Required Scenarios, Joint Analysis, and IOU Common Scenarios are described in more detail in the Joint IOU Testimony, Exhibit IOU-1.

C. Operating Needs to Integrate Renewable and Other Non-Dispatchable Resources

1. The CAISO System Operating Needs Are Evolving

Ensuring that the CAISO system remains reliable as increasing levels of renewable generation are incorporated into it raises new, complex challenges. Traditionally, the focus of long-term resource planning was how rapidly demand would grow on the system, and how to meet that growth using the loading order adopted by the CPUC in the Energy Action Plan. On the resource side, it is generally understood that resources that were added to the

^[3] *Assigned Commission and Administrative Law Judge’s Scoping Memo and Ruling (“Scoping Memo”), issued December 3, 2010, at p. 24.*

1 system had sufficient “operational flexibility” and could be ramped up and
2 down by the CAISO, as necessary, to meet daily variations in load.

3 Within this framework, the primary focus was having an adequate
4 planning reserve margin (“PRM”) to ensure that the operating resources
5 could be expected to meet the peak demand on the system with a high degree
6 of confidence. The PRM for a system was the difference between the
7 reliability value of the generating facilities available on a planning basis to
8 meet load served on the system, and the peak load that could be expected on
9 the system.

10 However, the system operating needs have changed with the increasing
11 amount of resources whose generation is non-dispatchable, such as Combined
12 Heat and Power, or “intermittent,” such as wind and solar generation. As a
13 result of these changing conditions, a more complex process is evolving to
14 determine the level of generation that can be expected from these resources
15 over a wider number of hours than the traditional system peak. In particular,
16 the system needs to be more flexible than it is today, and any resource need
17 assessment should account for the flexibility requirements to integrate
18 planned intermittent and non-dispatchable resources.

19 The ability of available generation resources with operational flexibility
20 to follow the changes in “net demand” imposed on the system by the
21 difference between load and intermittent generation may be a constraining
22 variable from a planning perspective. Moreover, under certain conditions and
23 at certain times, generation from renewable resources will exceed the load on
24 the system. Ensuring that the system can reliably handle such a potential
25 imbalance might very well be a constraining factor in ensuring the reliability
26 of the system. Evaluating operating requirements in the face of significant
27 intermittent renewable generation makes long-term resource planning
28 considerably more complex than checking whether the reserve margin equals
29 or exceeds the required PRM.

30 The analysis that has been presented in this proceeding by both the
31 CAISO and the IOUs represents a further evolution of long-term resource
32 planning in the face of increased levels of intermittent and non-dispatchable
33 generation. The IOUs are using the CAISO’s analytic approach to evaluate
34 resource need for renewable integration. This approach consists of two steps.

Step 1 calculates the need for Regulation and Load Following services based on the variability and forecast errors associated with load and variable energy resources (wind and solar). Step 2 calculates Integration Need,^[4] Production Costs (fuel and variable Operation and Maintenance), and Greenhouse Gas Emissions for each generator in the Western Interconnection.

2. The Load Following Requirement Should Include the Day-Ahead Forecast

PG&E believes that the current forecast errors being used to estimate load following requirements may be insufficient to manage the intermittency of wind and solar generation, as the CAISO's methodology does not capture day-ahead forecast uncertainty, which could have a significant impact on determining whether there are sufficient resources to meet integration needs.

In their review of the CAISO's 33% RPS Analysis, the Lawrence Berkeley National Laboratory and the National Renewable Energy Laboratory ("LBNL-NREL")^[5] indicated that day-ahead forecast errors may be important for high penetrations of intermittent generation, and recommended either incorporating the day-ahead forecast error into the PLEXOS simulations or evaluating in general terms the potential impact of day-ahead forecast errors through post-processing of the PLEXOS model

^[4] "System Need" is defined as additional resources needed above 2020 in service capacity to meet the combined operational requirements associated with load and reserves, including the quantities identified in Step 1 for integration of variable energy resources. For purposes of this testimony, PG&E defines "Integration Need" as the need for resources in excess of the PRM requirement. PG&E recognizes that Integration Need as defined here is driven by other factors in addition to intermittent renewable resource integration.

^[5] "Draft: Review of PG&E Renewable Integration Model and CAISO 33% ROS Analysis" Lawrence Livermore National Laboratory, December 21, 2010, pp. 43-44.

1 results.^[6] As indicated in the LBNL-NREL Report, consideration of
2 day-ahead forecast errors may be important for high penetrations of
3 intermittent generation. The LBNL-NREL Report notes that other integration
4 studies, including the CAISO's 20% RPS study, accounted for the day-ahead
5 forecast uncertainty. In particular, additional generation units may need to be
6 committed to cover the day-ahead forecast uncertainty of load, and wind and
7 solar generation.

8 This potentially critical element has not been incorporated into the
9 current modeling methodology. However, as described in the Joint IOU
10 Testimony, the IOUs developed a scenario which considers the impact of
11 day-ahead forecast errors on integration. Including the day-ahead forecast
12 errors results in an incremental need for upward operational flexibility of
13 approximately 2,200 megawatts ("MW") compared with scenarios that do not
14 include day-ahead forecast uncertainty. PG&E believes that these results
15 provide a broader array of possible future outcomes and better understanding
16 of the range of forecast uncertainty that needs to be considered for operating
17 the system and of renewable resources' integration need. Coordination with
18 the CAISO to further advance this analysis will enhance the CPUC's
19 decision-making with respect to integrating renewables.

20 **3. Future Analytic Approaches Need to Capture Likely Operating** 21 **Conditions**

22 Through the course of these efforts, the CAISO and the IOUs have
23 learned a significant amount about the CAISO's system operating needs for
24 the integration of a significant amount of additional intermittent and
25 non-dispatchable resources. However, PG&E has concluded that this

[6] "Day ahead forecast errors can be large. Insufficient generation that can be ramped up or started in a quick enough timeframe to accommodate the day ahead over-forecast errors of variable generation will lead to violations. Or conversely insufficient generation that can be decommitted or ramped down to accommodate day-ahead under-forecast errors of variable generation could lead to increased over-generation conditions and curtailment. The CAISO model does not currently address this, but at high penetration of variable renewables day-ahead forecast errors could potentially drive the need for increased flexibility, depending on the makeup of the generation fleet with regard to start-times and ramp rates." See LBNL-NREL Report, pages 55-56. The LBNL-NREL Report was attached to the *Ruling Requesting Post-workshop Comments, Updating Standardized Planning Assumptions, and Providing Lawrence Berkeley Report on Modeling Issues* issued on December 23, 2010 in the LTPP.

analysis is not yet sufficiently robust to allow the Commission to determine whether additional resources are needed to ensure the continued reliable operation of the CAISO's system.

a. Primary Concerns on the Analytical Approach

PG&E's primary concerns are that:

- (1) The current analytic approach does not yet fully capture the full range of operating conditions that may be imposed on the system by the increase in intermittent renewable resources; and
- (2) There has not been enough time to explore a complete range of input assumptions to capture the range of future possibilities that should be considered to make the integration analysis robust enough for Commission determination of renewable integration needs.

b. Operating Conditions Not Captured in the Analytical Approach

While the CAISO's analytical approach is on the cutting edge, there is significant uncertainty as to whether it completely captures operating conditions that the CAISO and other neighboring systems currently experience, or will experience in the future, with the increase in intermittent resources. Conditions that the analytical approach should be able to capture include:

(1) Periods of Negative Pricing or Dump Energy

The current models do not show any periods with negative energy prices or dump energy. Instead, the Step 2 model uses an ideal dispatch where neighboring entities provide either infinite flexibility to reduce their imports into California or become an infinite sink for California's surplus energy. The modeling needs to be modified to consider more realistic assumptions regarding periods of negative pricing and dump energy. The CAISO has experience with negative and dump energy situations that could be included in the analysis. In addition, the actions of other balancing authorities should be considered in the analysis. For example, the Bonneville Power Administration ("BPA") is currently being forced to curtail wind resources to balance hydro generation and low loads, even without the increases planned for sale to California and

1 California's own additions, which reduce the state's ability to
2 accommodate BPA's surplus generation.[7]

3 **(2) Dispatch Constraints on Out-of-State Coal Resources**

4 To meet the Track I deadline for filing the CPUC-Required
5 Scenarios and IOU Common Scenarios, certain simplifications were
6 made to speed up the production simulations. These simplifications
7 resulted in violations to out-of-state coal start-ups and cycling. To
8 the extent possible, simulations should reflect these constraints to
9 reflect the realities of the system. This is possibly one of the
10 reasons why the PLEXOS model finds no negative prices or dump
11 energy in either the CPUC-Required Scenarios or IOU Common
12 Scenarios.

13 **(3) Additional Scenarios and Sensitivities Are Needed**

14 Both the CAISO and the IOUs evaluated different assumptions
15 than provided in the CPUC-Required Scenarios. However, there
16 was not enough time to consider important aspects of the study
17 which could significantly change future operations such as:
18 (1) uncertain forecast errors; (2) validation of integration
19 requirements being used in Step 2 using past and current experience
20 to determine how much flexibility the existing system is using to
21 integrate existing renewables; and (3) different carbon dioxide costs
22 for the rest of the Western Electric Coordinating Council than for
23 California resources.

24 Other parties in Track I of this proceeding have also raised
25 questions and concerns about the current analytic approach being
26 used to determine operating needs to integrate future additional
27 intermittent and non-dispatchable resources, and the results of prior
28 integration studies.

[7] For example, BPA reported on June 6, 2011 that it had implemented an environmental redispatch to reduce about 15% of wind generation in its balancing area since May 18, 2011. BPA's presentation can be found at: <http://www.nwcouncil.org/energy/Wind/meetings/2011/06/WIF%20SC%20Presentation%206-11.pdf>.

1 **c. Operation Flexibility Metrics**

2 To help validate and improve the CAISO’s methodology, inputs, and
3 study results, PG&E recommends that the Commission encourage the
4 CAISO to track a number of operating flexibility metrics. By tracking
5 actual operation against assumed model inputs and results, the
6 Commission and parties in this proceeding can gain a better
7 understanding and greater comfort with the findings of future integration
8 studies. PG&E has identified the following operating flexibility metrics
9 for consideration, which the CAISO could track and periodically publish
10 on its website to better inform market participants:

11 **(1) Wind and Solar Forecast Metrics**

12 The CAISO and IOU studies filed in this proceeding are based
13 on assumed improved wind forecast errors, and simulated solar
14 forecast errors without much solar forecast experience.[8] It is
15 important for the CAISO to track and validate improvements in
16 forecasting accuracy by comparing actual against simulated or
17 assumed forecast errors to validate the estimates of regulation and
18 following reserves used in the studies.

19 **(2) Regulation-Up/Down and Load Following-Up/Down Reserve Metrics**

20 Similarly, actual procurement of regulation services, and
21 commitment and dispatch of flexible capacity in actual operation
22 could be compared to regulation and following reserves assumed in
23 the studies. Flexibility services can be tracked in MWs or as a
24 percentage of peak demand and installed capacity of intermittent
25 resources being managed by the CAISO.

26 **(3) Dump Energy Metrics**

27 Over-generation conditions are expected to increase with higher
28 levels of non-dispatchable and intermittent resources. However,
29 PLEXOS analysis shows no over-generation conditions. Tracking

[8] For example, the wind hour-ahead forecast error is assumed equal to 3.8% of installed capacity in the summer, compared to actual forecast experience in the Participating Intermittent Resource Program of about 8.9%. For solar, the studies use simulated hour-ahead forecast errors which show customer photovoltaic (“PV”) errors and distributed PV errors that are 1/3 to 1/2 of concentrated solar forecast errors.

1 hours and energy traded in day-ahead and real-time markets at zero
2 or negative prices as a function of non-dispatchable and intermittent
3 generation can be useful signposts to detect over-generation
4 conditions.

5 In short, while the Track I analysis performed by the CAISO and the
6 Joint IOUs is a starting point, it is not conclusive and will require further
7 refinement and modifications.^[9] As a consequence, the results produced
8 in Track I of this proceeding should not be the basis for Commission
9 action regarding a determination of resources needed for the integration
10 of intermittent and non-dispatchable resources. Instead, further analysis
11 will be required before the Commission can more definitively determine
12 the CAISO system operating needs.

13 **D. Once-Through Cooling Issues and Local Capacity Requirements**

14 In this section, PG&E responds to the Commission's request "requiring the
15 Investor-Owned Utilities to conduct a needs analysis for locally constrained
16 areas,"^[10] and issues related to long-term renewables planning and need for
17 replacement generation infrastructure to eliminate reliance on power plants using
18 OTC.^[11]

19 **1. Once-Through Cooling Issues**

20 At this time, PG&E has not identified any need for additional resources
21 in northern California as a result of the retirement of OTC generating units
22 that PG&E anticipates may be retired by 2017.

23 **2. Analysis of PG&E's Local Capacity Requirements**

24 PG&E uses results from the CAISO Local Capacity Technical ("LCT")
25 analysis,^[12] and references the CAISO's OTC study activity to discuss
26 capacity requirements in locally constrained areas for northern California.

27 With the establishment of the CAISO LCT study stakeholder process, PG&E

[9] As an example, PG&E does not believe that the distributed generation resources included in all modeled scenarios would result in only savings with minimal or no additional cost on the distribution system.

[10] Scoping Memo, p. 21.

[11] Scoping Memo, p. 5.

[12] Link to the CAISO Local Capacity Requirements web site:
<http://www.caiso.com/1c44/1c44b8e0380a0.html>.

no longer performs local need requirement evaluation for its service areas. Instead PG&E works collaboratively with the CAISO in its process to develop Local Capacity Requirements (“LCR”). These requirements are provided to the Commission for consideration of the local resource adequacy requirements program.

According to the CAISO 2010/2011 Transmission Plan report, the CAISO conducted two types of LCT studies in 2010: (1) an LCT analysis for the 2011 resource procurement process; and (2) additional analyses for 2013 and 2015 to show the trend of near-term LCR need.^[13] Table 1 below summarizes the minimum capacity requirements determined in 2010 for 2011, 2013 and 2015.

With the exception of North Bay/North Coast and Kern, LCRs are trending down in PG&E’s service area as a result of planned transmission projects. The LCR increase in the North Bay/North Coast area is driven by the potential retirement of Pittsburg generation as a result of the State Water Resource Control Board’s (“SWRCB”) OTC policy.

TABLE 1
PACIFIC GAS AND ELECTRIC COMPANY
MINIMUM CAPACITY REQUIREMENTS BY LOCAL AREAS FROM CAISO STUDIES

Line No.	Investor-Owned Utility	Local Area	Determined Minimum Capacity Requirement (MW)		
			Year 2011	Year 2013	Year 2015
1	PG&E	Humboldt	205	191	197
2		North Bay/North Coast	734	933	935
3		Sierra	2,082	1,768	1,873
4		Stockton	682	469	491
5		Greater Bay Area	4,878	3,974	3,951
6		Greater Fresno	2,448	2,102	2,075
7		Kern	447	486	507

On May 4, 2010, the SWRCB adopted a policy to reduce water intake at electric power plants with once-through cooling. SWRCB published a list of power plants that are impacted by this new policy. Seven power plants in

^[13] CAISO 2013-2015 Local Capacity Technical Analysis Report:
<http://www.caiso.com/287c/287ca3cc28a80.pdf>.

PG&E service territory are identified.^[14] Table 2 lists those units in the Humboldt and Greater Bay Areas, along with the targeted compliance dates.

TABLE 2
PACIFIC GAS AND ELECTRIC COMPANY
LOCAL AREA ONCE-THROUGH COOLING POWER PLANTS

Line No.	Power Plant	Compliance Date & Status
1	Humboldt Bay	Shut down in 2011
2	Potrero	Shut down in 2011
3	Contra Costa	December 31, 2017
4	Pittsburg	December 31, 2017
5	Moss Landing	December 31, 2017

The assessment below provides a high-level overview of the LCT results and potential OTC policy impact to PG&E local areas in the near-term.

Capacity requirements in Humboldt and the Greater Bay Area were not negatively impacted, despite the shut down of the Humboldt Bay and Potrero Power Plants in 2011. On October 1, 2010, PG&E repowered the Humboldt Bay Power Plant with a state-of-the-art generating facility. The repowering project replaced former 105 MW Units 1 and 2, and the two 15 MW mobile emergency units. The new plant is equipped with a water cooling system that meets stringent SWRCB requirements. With a total output of 163 MW, the new power plant provides needed generation capacity to serve the Humboldt area.

In the Greater Bay Area, Potrero was shut down in early 2011 after the San Francisco Recabling Project and the TransBay Cable Project commenced commercial operation. The higher capacity underground cables in San Francisco and the new submarine cable technically replaces Potrero generation by transmitting additional electric power from the south and the east to San Francisco. From a capacity perspective, the shut down of the Potrero units did not create an area capacity deficiency concern.

Retirement of Contra Costa and Pittsburg Power Plants due to OTC policy could negatively impact the Greater Bay Area electric reliability if

^[14] Fact Sheet on once-through cooling policy:
http://www.waterboards.ca.gov/water_issues/programs/ocean/cwa316/docs/otc_fctsht.pdf.

needed energy resources are not replenished. Estimated loss of generation capacity from Contra Costa Units 6 and 7; Pittsburg Units 5, 6 and 7 is about 2,000 MW. However, according to the California Energy Commission's power plant project database^[15] and interconnection records, Table 3 shows four known projects that could potentially bring new generation capacity to the Bay Area, thus mitigating this potential issue.

TABLE 3
PACIFIC GAS AND ELECTRIC COMPANY
POTENTIAL BAY AREA GENERATION PROJECT STATUS AND FORECAST ON-LINE DATE

Line No.	Project	Status	Capacity (MW)	County Location	Forecast On-Line Date
1	Russell City	Under Construction	579	Alameda	2013
2	Marsh Landing	Pre-Construction	719	Contra Costa	2013
3	Mariposa	Received CEC Approval	184	Alameda	2012
4	Oakley	Received CEC Approval	586	Contra Costa	2016

When successfully permitted, constructed, and energized, these four projects will provide about 2,100 MW of new generation capacity, enough to compensate for the potential loss of capacity at the Contra Costa and Pittsburg Power Plants.

Separately the CAISO is sponsoring a stakeholder activity^[16] to evaluate the OTC impact that includes demand side resource/renewables supply scenarios reflecting 33% of energy deliveries by 2020. While the CAISO's OTC study is still ongoing, PG&E predicts load centers such as the Greater Bay Area will be reliably served in 2020. Based on the results from the 2015 LCT analysis, PG&E estimates the Greater Bay Area capacity requirement will be in the range of 4,200-4,700 MW.^[17] The area qualifying capacity is presently registered at 6,506 MW.^[18] Therefore, assuming no major

^[15] CEC generation project status website:
http://www.energy.ca.gov/sitingcases/all_projects.html.

^[16] CAISO once-through cooling generation study website:
<http://www.caiso.com/1c58/1c58e7a3257a0.html>.

^[17] Assuming a load growth rate of 50 MW on the low end, and a 150 MW on the high end. Average growth rate for the Greater Bay Area is roughly 100 MW per year. Calculated 2015 LCR need was 3,951 MW.

^[18] Taken from the CAISO 2013-2015 Local Capacity Technical Analysis Report.

1 generation reduction, available local area capacity is enough to meet the
2 projected capacity requirement in 2020 during peak hour demand. Having
3 satisfied local capacity requirements does not necessarily satisfy systemwide
4 resource need that may be identified for reliability or renewable integration.

5 Apart from capacity requirement evaluation, PG&E and the CAISO
6 perform annual reliability assessment on PG&E's transmission grid.
7 Assessment results for the next 10 years, and transmission project proposals
8 are documented in the annual CAISO Transmission Plan.[19]

9 The impact of the OTC policy can be minimized when proposed
10 Bay Area generation projects and necessary network upgrades are installed
11 before the actual implementation of the new policy. A more refined capacity
12 need projection will be available when the CAISO's OTC study is completed.

13 **3. Greater Fresno Local Area**

14 There are several system issues for PG&E's Transmission System in the
15 Greater Fresno Area. The Greater Fresno Area transmission system must
16 have the capability to serve load while meeting reliability standards. Among
17 other requirements, the loadings on the transmission facilities must be below
18 their thermal ratings and voltage instability (or collapse) must not occur.

19 The Greater Fresno Area is dependent on Helms generation (about 40%
20 of area generation capacity) and other limited energy conventional hydro
21 resources to serve the load during peak hours. If Helms cannot generate, the
22 Fresno Area may face load shedding. Potentially, voltage collapse could
23 cascade and could cause wide area blackouts beyond the Greater Fresno area.
24 The CAISO also has identified in its 2010/2011 Transmission Planning
25 Process[20] that Helms pumping load is critical in accommodating high
26 levels of renewable generation considered in the study. Having the Midway–
27 Gregg 500 kilovolts line would allow Helms to operate in the pumping mode
28 with all three pumps operating under most expected off-peak load levels and,
29 thus, over a flexible window of hours in the 2020 time frame and beyond.

[19] CAISO Transmission Planning Process website:
<http://www.caiso.com/286e/286e7bed428f0.html>.

[20] Draft California ISO 2010/2011 Transmission Plan March 24, 2011
(<http://www.caiso.com/2b4b/2b4bf09070b00.pdf>).

E. Conclusion

As described above, the complexity and challenges of integrating intermittent and non-dispatchable resources into the CAISO system requires a rigorous and thorough analysis to ensure that system reliability and operability is not compromised. The CAISO's and IOU's understanding of operating characteristics necessary for integration, and the resources which have them, are continuing to evolve. There is also significant uncertainty about the current modeling techniques, assumptions and results. As a result, PG&E does not believe there is sufficient information to render a finding on integration needs or procurement authority at this time.

In summary, PG&E reiterates its recommendation that the Commission should not render a decision regarding the integration need, as the analysis and results are premature and inconclusive. In addition, PG&E recommends that the Commission encourage the CAISO to track operating flexibility metrics to validate this and future integration study results. PG&E is not requesting any authorization for procurement authority relating to local capacity requirements at this time.

PACIFIC GAS AND ELECTRIC COMPANY
APPENDIX A
STATEMENTS OF QUALIFICATIONS

1 **PACIFIC GAS AND ELECTRIC COMPANY**
2 **STATEMENT OF QUALIFICATIONS OF ANTONIO J. ALVAREZ**

3 Q 1 Please state your name and business address.

4 A 1 My name is Antonio J. Alvarez, and my business address is Pacific Gas and
5 Electric Company, 245 Market Street, San Francisco, California.

6 Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company
7 ("PG&E").

8 A 2 I am a manager within the Energy Policy, Planning and Analysis department
9 of PG&E's Energy Procurement organization. I lead the team responsible for
10 renewable integration issues.

11 Q 3 Please summarize your educational and professional background.

12 A 3 I earned a bachelor of science degree in civil engineering from the
13 Universidad Javeriana, a masters degree in engineering management from
14 Stanford University, and a masters degree in business administration from the
15 Haas School of Business at the University of California, Berkeley. I joined
16 PG&E in September 1977 and have held various positions in planning and
17 contract analysis and administration.

18 Q 4 What is the purpose of your testimony?

19 A 4 I am sponsoring the following sections of the 2010 Long-Term Procurement
20 Plan Track I (System Resource Plan) Joint IOU Supporting Testimony and
21 the PG&E Utility Specific Supporting Testimony:

- 22 • Joint IOU Supporting Testimony:
- 23 – Chapter 3, "Results."
- 24 – Chapter 4.C, "Scenario 2 – Day-Ahead Forecast Uncertainty."
- 25 – Chapter 4.E, "Temperature Peak Sensitivity."
- 26 – Chapter 5.H, "Helms Modeling Constraint."
- 27 • PG&E Utility Specific Supporting Testimony:
- 28 – Section B, "Background."
- 29 – Section C, "Operating Needs to Integrate Renewable and Other
30 Non-Dispatchable Resources."

31 Q 5 Does this conclude your statement of qualifications?

32 A 5 Yes, it does.

PACIFIC GAS AND ELECTRIC COMPANY
STATEMENT OF QUALIFICATIONS OF
JANICE FRAZIER-HAMPTON

Q 1 Please state your name and business address.

A 1 My name is Janice Frazier-Hampton, and my business address is Pacific Gas and Electric Company, 245 Market Street, San Francisco, California.

Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company ("PG&E").

A 2 I am director of Integrated Resource Planning within the Energy Policy, Planning and Analysis department of PG&E's Energy Procurement organization. My department is responsible for long-term planning for energy procurement which focuses on resource portfolios to meet the needs of bundled electric customers.

Q 3 Please summarize your educational and professional background.

A 3 I have a bachelor of business administration in finance from Northeast Louisiana University, Monroe, LA, and a master of business administration degree with a concentration in finance from Golden Gate University, San Francisco.

I joined PG&E in 1982 and have held various positions of increasing responsibility in several departments including Finance, Regulatory Relations and Energy Procurement. I assumed my current position in March 2010.

Q 4 What is the purpose of your testimony?

A 4 I am sponsoring the following sections of the 2010 Long-Term Procurement Plan Track I (System Resource Plan) Joint IOU Supporting Testimony and the PG&E Utility Specific Supporting Testimony:

- Joint IOU Supporting Testimony:
 - Chapter 1, "Joint Investor-Owned Utilities Policy Recommendation."
 - Chapter 2, "Overview of Analytic Framework the California Public Utilities Commission-Required Scenarios."
 - Chapter 6 "Conclusion."
- PG&E Utility Specific Supporting Testimony:
 - Section A, "Introduction and Summary of Recommendations."
 - Section E, "Conclusion."

- 1 Q 5 Does this conclude your statement of qualifications?
- 2 A 5 Yes, it does.

PACIFIC GAS AND ELECTRIC COMPANY
STATEMENT OF QUALIFICATIONS OF ROBERT S. GOMEZ

Q 1 Please state your name and business address.

A 1 My name is Robert S. Gomez, and my business address is Pacific Gas and Electric Company, 245 Market Street, San Francisco, California.

Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company ("PG&E").

A 2 I am a principle within the Energy Policy, Planning and Analysis department of PG&E's Energy Procurement organization. I work with the section responsible for all Integrated Resource Planning matters. My responsibilities include analyzing regional and utility needs; developing and utilizing various forecasting methodologies for market prices, resources and demand; developing and maintaining data inputs for models used to value transactions and forecast price; and assisting in the evaluation of transactions and resources.

Q 3 Please summarize your educational and professional background.

A 3 I received a bachelor of science degree in molecular and cellular biology from the University of Arizona in 1996, and a master of business administration degree in operations management from the University of Arizona, the Eller School of Management, in 2001. I joined PG&E in 2002 as a resource planning analyst developing forecast models and methodologies for various components of PG&E's portfolio for procurement planning purposes. Prior to my employment with PG&E, I worked for IBM as a market sector analyst.

Q 4 What is the purpose of your testimony?

A 4 I am sponsoring the following sections of the 2010 Long-Term Procurement Plan Track I (System Resource Plan) Joint IOU Supporting Testimony:

- Chapter 5.A.2, "Introduction."
- Chapter 5.B.2, "Pacific Gas and Electric Company's Service Area."
- Chapter 5.C.2, "Pacific Gas and Electric Company's Service Area."
- Chapter 5.D.2, "Pacific Gas and Electric Company's Renewables Portfolio Standard Build-Out."
- Chapter 5.E.2, "Pacific Gas and Electric Company's Service Area."
- Chapter 5.F.2, "Pacific Gas and Electric Company's Service Area."

- 1 Q 5 Does this conclude your statement of qualifications?
- 2 A 5 Yes, it does.

PACIFIC GAS AND ELECTRIC COMPANY
STATEMENT OF QUALIFICATIONS OF
BANGALORE VIJAYRAGHAVEN

Q 1 Please state your name and business address.

A 1 My name is Bangalore Vijayraghavan, and my business address is Pacific Gas and Electric Company, 77 Beale Street, San Francisco, California.

Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company ("PG&E").

A 2 I am the manager of the Interconnected Grid Planning section of Electric Planning and Strategy department at PG&E. My responsibilities include managing the electric transmission system planning activities for PG&E by coordinating with the California Independent System Operator's TPP process. I support the Company's transmission planning for interconnection of renewable generation within the PG&E service area. I have been employed by PG&E, working in the Company's transmission department since November 1999. During my current tenure at PG&E, I have been involved in developing transmission planning studies, projects, transmission level load forecasting and the Western Electric Coordinating Council ("WECC") regional planning studies. I am representing PG&E in the California Transmission Planning Group's study group. I am also the Company's member of the WECC Planning Coordination Committee and the Reliability Subcommittee. Prior to joining PG&E in 1999, I was employed at Green Mountain Power Company-Vermont from 1982-1999 as an electrical engineer responsible for all of transmission planning.

Q 3 Please summarize your educational and professional background.

A 3 I have a master's degree in electrical engineering from Clarkson University-Potsdam, New York, and a bachelor of engineering degree from Mysore-University, Mysore, India. I have been employed by PG&E within its transmission department since November 1999.

Q 4 What is the purpose of your testimony?

A 4 I am sponsoring the following section of the 2010 Long-Term Procurement Plan Track I (System Resource Plan) PG&E Utility Specific Supporting Testimony:

- 1 • Section D, “Once-Through Cooling Issues and Local Capacity
2 Requirements.”
3 Q 5 Does this conclude your statement of qualifications?
4 A 5 Yes, it does.

PACIFIC GAS AND ELECTRIC COMPANY
STATEMENT OF QUALIFICATIONS OF RAYMOND D. WILLIAMS

Q 1 Please state your name and business address.

A 1 My name is Raymond D. Williams, and my business address is Pacific Gas and Electric Company, 245 Market Street, San Francisco, California.

Q 2 Briefly describe your responsibilities at Pacific Gas and Electric Company (“PG&E”).

A 2 I am a director within the Energy Policy, Planning and Analysis department of PG&E’s Energy Procurement organization. I oversee the team responsible for all long term energy policy planning matters.

Q 3 Please summarize your educational and professional background.

A 3 I graduated from Clark University in 1975 with a bachelor of arts degree in geography and from Stanford University in 1981 with a master of science degree in civil engineering. From 1975 to 1979, I was employed by the Massachusetts Executive Office of Environmental Affairs.

I began work with PG&E in 1981. In June 2004, I became a director supporting regulatory activities and policy development related to long-term energy policy and procurement, including PG&E’s policies regarding greenhouse gas policy development and implementation.

Q 4 What is the purpose of your testimony?

A 4 I am sponsoring the following section of the 2010 Long-Term Procurement Plan Track I (System Resource Plan) Joint IOU Supporting Testimony:

- Appendix B, “Assessment of Long-Term Implications for Greenhouse Gas Emissions.”

Q 5 Does this conclude your statement of qualifications?

A 5 Yes, it does.